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IS : 4380 - 1967

# Indian Standard

# SPECIFICATION FOR ABNEY LEVEL

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**INDIAN STANDARDS INSTITUTION**
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

*February* 1968

# *Indian Standard*
# SPECIFICATION FOR ABNEY LEVEL

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# *Indian Standard*

# SPECIFICATION FOR
ABNEY LEVEL

## 0. FOREWORD

**0.1** This Indian Standard was adopted by the Indian Standards Institution on 24 November 1967, after the draft finalized by the Optical and Mathematical Instruments Sectional Committee had been approved by the Mechanical Engineering Division Council.

**0.2** An Abney level is an instrument for rough survey work and is used mostly for plotting contours in topographic surveying. It is suitable both for direct levelling and for measuring the slopes.

**0.3** Assistance has been derived from B.S. 1871 : 1952 'Minimum requirements for silvering for glass reflectors for lighting purposes', issued by the British Standards Institution.

**0.4** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS: 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

## 1. SCOPE

**1.1** This standard covers the functional and general requirements of Abney levels.

## 2. GENERAL REQUIREMENTS

**2.1** The bubble shall be of cylindrical type conforming to IS : 1632-1960†.

**2.2** The magnifier shall conform to IS : 988-1959‡.

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*Rules for rounding off numerical values ( *revised* ).
†Specification for bubbles.
‡General requirements for optical components.

**2.3** The main scale shall be graduated both in degrees and in percentage of slope.

**2.4** The vernier shall slide in contact with the main scale throughout its run.

**2.5** The arm shall be free to rotate along with the bubble tube with the help of a slow motion screw.

**2.6** The bubble tube shall be pivoted and shall carry an index arm perpendicular to its axis.

**2.7** The bubble tube shall have opening at the top and at the bottom.

**2.8** The sighting tube shall be square in section and shall be fitted with a reflector and a sighting line.

**2.9** The metal body of the sighting tube shall be cut away under the level tube to afford a view of the bubble.

**2.10** The sighting tube shall be finished dull black inside.

**2.11 Case** — The instrument shall be supplied in a leather case of good quality. All stitching shall be neat, regular and fastened off with a binder stitch. The leather loops stitched to the case shall allow sufficient clearance for the sling to be freely inserted. The leather case shall be so designed as to hold the accessories also in an enclosed manner.

## 3. FUNCTIONAL REQUIREMENTS

**3.1** The arc and vernier shall be accurately divided with fine sharp lines.

**3.2** The vernier shall be truly concentric and be flat on the arc.

**3.3** The rulings of the vernier shall be truly radial.

**3.4** The reflector shall be set accurately at an angle of 45° inside the sighting tube and shall occupy half of its width.

**3.5** The vernier shall be provided with a magnifier. The magnifier mount shall be friction tight in the holder in any position and when moved shall not affect the setting of the vernier.

**3.6** The underside of the sighting tube shall be perfectly flat.

**3.7** The slow motion device shall work smoothly and evenly.

**3.8** The reflector shall be a perfectly flat reflecting surface. The surface shall be highly polished and free from scratches and any other defects.

# AMENDMENT NO. 1 MARCH 1971

## TO

# IS : 4380-1967 SPECIFICATION FOR ABNEY LEVEL

### Alterations

( *Page* 4, *clause* 3.2 ) — Substitute the following for the existing clause:

**3.2** The vernier shall be truly concentric and there shall be no gap between the main scale and the vernier.'

( *Page* 5, *clause* 4, *heading* ) —
Substitute 'TECHNICAL REQUIREMENTS'
*for* 'GENERAL REQUIREMENTS'.

( *Page* 5, *clause* 5.1, *line* 3 ) — Substitute 'If the error exceeds 10 minutes' *for* 'If the difference is appreciable'.

( *Page* 6, *clauses* 6.1 *and* 6.2 ) — Substitute the following for the existing clauses:

'**6.1** The weight of the instrument shall not exceed 250 g.

**6.2** The weight of the carrying case of the instrument shall not exceed 150 g.'

### Addendum

( *Page* 6, *clause* 5.3.4 ) — Add the following new clause after **5.3.4** and re-number the existing clauses '**5.4** and **5.5**' as '**5.5** and **5.6**' respectively:

'**5.4** The reflectivity of the reflector shall not be less than 65 percent.'

( EDC 36 )

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**3.9** The sighting line shall be coincident with the cross wire in the sighting tube when viewed through the eye-end of the tube.

## 4. GENERAL REQUIREMENTS

**4.1** The main scale shall be graduated every degree from −90° to +90°, every 10-degree line being numbered. It shall also be graduated in percentage of slope from 0 to 100, every 20-percent mark being numbered or as required by the purchaser.

**4.2** The graduations on the vernier scale and the main scale shall be so marked that six graduations on the vernier scale correspond to five graduations on the main scale, so that the scale may be read to 10 minutes with the aid of the vernier.

**4.3** The magnification of the magnifier used for vernier reading shall be not less than 4 *X*.

**4.4** The sensitivity of the bubble shall be 20 minutes per 2 millimetre run.

## 5. TESTS

**5.1** The zero error of the vertical circle shall be determined before use by comparing a reading with that of a theodolite taken to the same point. If the difference is appreciable the level shall be directed at the object with the scale set to the correct reading; the bubble then being centred by the capstan screws.

**5.1.1** The error observed after the test at **5.1** shall not exceed 10 minutes.

**5.2** The level shall be placed on a truly horizontal surface and vernier set to zero reading. When viewed through the eye-end of the sighting tube, the image of the bubble shall appear bisected by the line of sight; and in this position both ends of the vernier graduation shall be coincident with the corresponding lines on the main scale and both the edges of the vernier arm shall coincide with the two graduations on the elevation and depression scales.

**5.3** When the bubble is centred the line of sight horizontal shall be tested as given below.

**5.3.1** Two points *A* and *B* should be taken 50 m apart and the level shall be placed on a truly horizontal surface at exactly the centre of *AB*.

**5.3.2** The instrument shall be levelled and a levelling staff (*see* IS : 1779-1961* ) placed at *A*. Seeing through the level, the reading should be taken on the staff. Let this reading be *X*.

**5.3.3** The level should then be reversed, the staff placed at *B* and reading should be taken on the staff. Let this reading be *Y*.

**5.3.4** Let the difference of level between the points *A* and *B* be *Z*. Then, if the line of sight is parallel to the level bubble, the difference of *X* and *Y* is equal to *Z*.

**5.4 Drop Test** — The instrument packed in its case shall be dropped three times on each face from a height of 300 mm on to 150 mm deep layer of fine sand contained in a box and covered with one layer of canvas. The instrument shall be in correct adjustment after the test.

**5.5 Vibration Test** — The instrument shall be clamped on a vibrating table giving approximately 450 vibrations per minute with an amplitude of 1·5 mm for a period of five minutes. The instrument shall be in correct adjustment after the test.

## 6. WEIGHT

**6.1** The weight of the level shall not exceed 230 g.

**6.2** The weight of the carrying case of the level shall not exceed 100 g.

## 7. MARKING

**7.1** The level shall be suitably marked legibly and indelibly with the manufacturer's name or trade-mark and also the year of manufacture if desired by the purchaser.

**7.1.1** The level may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution ( Certification Marks ) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

## 8. PACKING

**8.1** Each level shall be supplied in a leather case together with an instruction booklet containing the broad features of the instrument, the reading device, the system of adjustment, etc.

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*Specification for 4-metre, levelling staff, folding type.

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